Notices

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CAUTION

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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.
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1 Installation Guide

This chapter describes the necessary operations to perform before using the delivered Bottom Electrode SMD Test Fixture 16197A.

Inspection before Unpacking

Upon receiving the product package, inspect the packing box before unpacking to make sure it is not damaged. If the packing box or packing materials have been damaged, keep the box and materials until it has been confirmed that all necessary components have been delivered and that product operation is normal both mechanically and electrically.

Check the package contents against Table 1-1. If any component is missing, or mechanically damaged or defective, please contact Keysight Technologies local sales office. If the packing box has been damaged or the packing materials have been severely deformed, please contact the freight company as well as our sales office. Until the freight company carries out its inspection, store the packing box and materials as they are, with all product components left inside.

NOTE

Before using this product for the first time after delivery, carry out “Deterioration Check” on page 47, which is necessary to ensure accurate measurement. For details, see “Acquiring Reference Values” on page 48 of the “Deterioration Check” section.
Figure 1-1 Package Contents of 16197A

1. Test fixture (Electrode unit)  
1. Test fixture (Pressure unit)

2. Device guide*1  
3. Blank device guide  
4. Electrode plate*2  
5. Shorting bar set

6. Tweezers  
7. Allen wrench  
8. Magnifying glass

9. Cleaning Rod

*1 One is Delivered attached to the test fixture.  *2 Delivered attached to the test fixture.

Option 001

10. Carrying case  
11. Operation and service manual

12. Shorting bar  
13. Device guide  
14. Electrode plate
### Table 1-1

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Keysight part number</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bottom-electrode SMD test fixture 16197A</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Device guide ¹</td>
<td>16197-25005</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Blank device guide</td>
<td>16197-25006</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Electrode plate ²</td>
<td>16197-00603</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>EIA/EIAJ-size, Shorting bar set</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shorting bar 1.0 x 0.5 x 0.5³</td>
<td>16191-29005</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Shorting bar 1.6 x 0.8 x 0.8³</td>
<td>16191-29006</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Shorting bar 2.0 x 1.2 x 0.8³</td>
<td>16191-29007</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Shorting bar 3.2 x 1.6 x 0.8³</td>
<td>16191-29008</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Tweezers</td>
<td>8710-2081</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Allen wrench</td>
<td>8710-0909</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Magnifying glass</td>
<td>16193-60002</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Cleaning rod</td>
<td>5182-7586</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Carrying case</td>
<td>16197-60060</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Operation and service manual (this manual)</td>
<td>16197-90020</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Option 001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Shorting bar 0.6 x 0.3 x 0.3</td>
<td>16197-29001</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Device guide</td>
<td>16197-25007</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>Electrode plate</td>
<td>16197-00604</td>
<td>1</td>
</tr>
</tbody>
</table>

1. One is Delivered attached to the test fixture
2. Delivered attached to the test fixture
3. Shorting bars are delivered together in one case.
Assembly and Storage of 16197A

The 16197A is delivered in a carrying case, disassembled into a pressure unit and an electrode unit. Assemble the fixture before use. Disassemble the fixture when storing it in the carrying case.

Assembly of 16197A

Before using the 16197A, install the pressure unit onto the electrode unit as shown in Figure 1-2.

Figure 1-2 Installing the Pressure Unit

Installing the Magnifying Glass

If the magnifying glass is used, install it on the edge of the electrode unit as shown in Figure 1-3.
Storage

Before storing the 16197A, remove the pressure unit from the electrode unit (Figure 1-4) and loosen the pressure adjusting nut on the pressure unit (Figure 1-5). Also remove the magnifying glass, if installed.
Figure 1-5  Pressure Adjusting Nut

Pressure adjusting nut

To increase pressure

To decrease pressure
Changing the Positions of the Guide Holder Fixing Screws

If the guide holder fixing screws hamper operation, the positions of these screws can be changed.

Figure 1-6 Positions of the Guide Holder Fixing Screws

- **Guide holder fixing screws**
- **Screw positions at the time of delivery**
- **Screw position after changing**
Method for Changing the Positions of the Guide Holder Fixing Screws

Before changing the positions of the fixing screws, remove the pressure unit.

Step 1. Remove the four screws that fix the guide holder flange (Figure 1-7).

Step 2. Rotate the guide holder by 90 degrees together with components fixed on the flange, and again set the guide holder in place (Figure 1-7).
Connecting the Test Fixture with a Measuring Instrument

Connecting the test fixture 16197A with a measuring instrument requires an adapter suited to the instrument.

The test fixture 16197A is suitable for use with a high-frequency LCR meter or an impedance analyzer. Table 1-2 shows possible adapter combinations.

### Table 1-2 Adapter for a Measuring Instrument

<table>
<thead>
<tr>
<th>Measuring Instrument</th>
<th>Adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>E4991A</td>
<td>Test head (supplied with the E4991A)</td>
</tr>
<tr>
<td>E4991B</td>
<td>Test head (supplied with the E4991B)</td>
</tr>
<tr>
<td>E4982A</td>
<td>Test head (supplied with the E4982A), Test Fixture Stand (Opt. 710) and 3.5mm- 7mm Coaxial Adapter (opt.720)</td>
</tr>
<tr>
<td>4294A, E4990A-120</td>
<td>42942A terminal adapter</td>
</tr>
<tr>
<td>E5061B-3L3/3L4/3L5 with Opt. 005</td>
<td>16201A</td>
</tr>
</tbody>
</table>

The test fixture 16197A can also be connected with any measuring instrument with 4-terminal pair configuration if an appropriate adapter is used.

For the procedure for attaching an adapter, see the Operation Manual for the adapter.

---

**NOTE**

Calibration on the 7-mm connector surface may be necessary depending on the type of measuring instrument. In such a case, perform calibration on the 7-mm connector surface before connecting the test fixture with the measuring instrument. For details, see the Operation Manual for the measuring instrument.

---

Below is the general procedure for attaching an adapter to the test fixture. (For details, see the Operation Manual for each adapter.

1. **Step 1.** Rotate the 7mm connector on the adapter counterclockwise as viewed from above to completely retract the connecting sleeve.

2. **Step 2.** Gently place the test fixture onto the adapter, aligning the mounting holes with the mounting posts on the adapter, and the 7mm connector with that on the adapter.
Step 3. Rotate the 7mm connector on the adapter counterclockwise as viewed from above to connect it with the connector on the bottom of the test fixture.

**NOTE**

Turn the 7-mm connector on the adapter using a 3/4-inch torque wrench with 12 lb-inch torque (Keysight part number: 8710-1766) to firmly connect the test fixture.

Figure 1-8 Installing the Test Fixture
2  Product Description

Product Description

The 16197A is a test fixture for use in measuring bottom-electrode chip components. It enables highly accurate and repeatable measurement of chip-type capacitors, inductors, and other similar components. The 16197A is compatible with measuring frequencies to 3GHz, and can accommodate bottom-electrode chip components of sizes 3225 1(12102), 3216(12062), 2012 1 (08052), 1608 1(06032), and 1005 1(04022). Measurement of chip components of other sizes is possible by preparing appropriate device guides. Measurement of a bottom-electrode chip component of size 0603 1(02012) is also possible using the option.

Figure 2-1  Product Appearance

1. EIAJ size
2. EIA size
Mechanism for Connecting a DUT (Device Under Test)

The 16197A uses a device guide and an electrode plate for measuring to various sizes of bottom-electrode SMDs.

The electrode plate is placed onto the center electrode of the electrode unit, producing four different electrode spaces between the center electrode and electrode plate (Figure 2-2).

Figure 2-2  Structure of Electrode (1)

The device guide is placed on the electrode plate to enable each DUT to be positioned in a fixed location (Figure 2-3). Each DUT is set in a frame of the size suitable to the DUT for connecting to the electrode (Figure 2-4).
The DUT is to be fixed under pressure from the pressure rod. Since the movable range of the pressure rod is limited, either one of the two lateral frames in the device guide can be used as the measuring position (Figure 2-5). Therefore, before connecting a DUT, it may be necessary to change the orientation of the electrode plate and device guide set in place so that the appropriate electrode and device guide frame arrive at the measuring position.
Figure 2-5  Measuring Position for Each Device Size

Measuring position for 1608  Measuring position for 2012

Measuring position for 1005  Measuring position for 3216 (3225)

Measuring position for 0603 (Option 001)
Names & Functions of Parts

Figure 2-6 shows the part names for the 16197A.

Table 2-1 Names & Functions of Parts

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lever</td>
<td>Used to raise or lower the pressure rod</td>
</tr>
<tr>
<td>2</td>
<td>Latch</td>
<td>Used to fix the lever to retain the pressure rod in its raised position</td>
</tr>
<tr>
<td>3</td>
<td>Knob</td>
<td>Used to fix the pressure unit</td>
</tr>
<tr>
<td>4</td>
<td>Sliding block</td>
<td>Used to laterally move the pressure unit</td>
</tr>
<tr>
<td>5</td>
<td>Pressure rod</td>
<td>Used to fix the DUT by downward pressure during measurement</td>
</tr>
<tr>
<td>6</td>
<td>Guide holder</td>
<td>Used to fix the electrode plate and device guide</td>
</tr>
<tr>
<td>7</td>
<td>Pressure adjusting nut</td>
<td>Used to adjust the DUT-retaining pressure of the pressure rod</td>
</tr>
<tr>
<td>8</td>
<td>Pressure unit</td>
<td>Apparatus to retain the DUT, etc.</td>
</tr>
</tbody>
</table>
Names & Functions of Accessories

Figure 2-7 shows the names of standard accessories of the 16197A, and those of accessories available in Option 001.

Table 2-1

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Electrode unit</td>
<td>The electrode section to which the DUT, etc. are connected</td>
</tr>
</tbody>
</table>

Table 2-2

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Device guide</td>
<td>Used to position the DUT, etc. when connecting it to the electrode</td>
</tr>
<tr>
<td>2</td>
<td>Blank device guide</td>
<td>Used to prepare a device guide frame suited to a DUT of a size not fitting any frame in the attached device guide</td>
</tr>
<tr>
<td>3</td>
<td>Electrode plate</td>
<td>Used to create various electrode spaces</td>
</tr>
<tr>
<td>4</td>
<td>Shorting bar set</td>
<td>Shorting bars in EIA/EIAJ sizes, and a case for storing them. These bars are used during of SHORT compensation.</td>
</tr>
</tbody>
</table>
### Table 2-2 Names & Functions of Accessories

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Tweezers</td>
<td>Used to handle shorting bars, the DUT, etc.</td>
</tr>
<tr>
<td>6</td>
<td>Allen wrench</td>
<td>Used to tighten/loosen hexagonal nuts</td>
</tr>
<tr>
<td>7</td>
<td>Magnifying glass</td>
<td>Used to magnify the view of a connector, electrode, etc.</td>
</tr>
<tr>
<td>8</td>
<td>Cleaning rod</td>
<td>Used to clean the electrodes. Refer to “Cleaning Method” on page 45 in Chapter 4.</td>
</tr>
</tbody>
</table>

**Option 001**

<table>
<thead>
<tr>
<th>9</th>
<th>Device guide</th>
<th>Device guide for 0603 devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Electrode plate</td>
<td>Electrode plate for 0603 devices</td>
</tr>
<tr>
<td>11</td>
<td>Shorting bar</td>
<td>Shorting bars for 0603 devices, and a case for storing them. These bars are used during SHORT compensation.</td>
</tr>
</tbody>
</table>

a. Delivered attached to the electrode unit
3 Operation

This chapter describes the procedures for measurement preparation, fixture compensation, connection of a DUT, and measurement with the 16197A.

Measurement Flow

To measure a DUT by taking measurements with the 16197A, follow the procedure below.

**Step 1. Setting the measuring conditions**
Set the measuring conditions for the measuring instrument to be used.

**Step 2. Performing calibration**
Calibrate the measuring instrument adapters, if necessary.

**Step 3. “Setting the Electrical Length” on page 25**
Set the electrical length for the measuring instrument, if necessary.

**Step 4. “Changing the Orientation of the Device Guide and Electrode Plate” on page 25**
Select a device guide frame that fits the configuration of the DUT, and change the orientation of the device guide and electrode plate set on the center electrode, if necessary.

**Step 5. “Performing Fixture Compensation” on page 35**
Measure the SHORT compensation and OPEN compensation data.

**Step 6. “Connecting and Measuring the DUT” on page 40**
Connect the DUT to the fixture and perform the measurement.

---

**WARNING**

The 16197A has the capability for -55°C to +85°C temperature measurement in environmental testing. Use gloves to prevent burns when handling heated parts.
The calibration methods, electrical length setting, and fixture compensation all differ with the measuring instrument being used. See the operation manual for the measuring instrument to be used.

**NOTE**

To ensure accurate measurement with the 16197A, it is necessary to perform a deterioration check of the shorting bars. For details, see “Deterioration Check” on page 47
Operation
Setting the Electrical Length

Setting the Electrical Length

Set the electrical length for the measuring instrument, if necessary. For the method of setting the electrical length, see the operation manual for the measuring instrument. The electrical length for the 16197A is as follows:

<table>
<thead>
<tr>
<th>Model</th>
<th>Electrical length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16197A</td>
<td>14.00 mm</td>
</tr>
</tbody>
</table>

Changing the Orientation of the Device Guide and Electrode Plate

Select a device guide frame suited to the DUT size, and mount the appropriate device guide and electrode plate in the proper orientation so that a suitable frame is located at the measuring position.

Selecting the device guide frame

Select a device guide frame suited to the DUT size, with reference to Table 3-1.

Table 3-1 Device Guide Frames and Applicable Device Sizes and Specifications

<table>
<thead>
<tr>
<th>Frame Position</th>
<th>Device Size</th>
<th>Applicable chip size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EIAJ size</td>
<td>EIA size</td>
</tr>
<tr>
<td>1</td>
<td>3225</td>
<td>1210</td>
</tr>
<tr>
<td></td>
<td>3216</td>
<td>1206</td>
</tr>
<tr>
<td>2</td>
<td>2012</td>
<td>0805</td>
</tr>
<tr>
<td>3</td>
<td>1608</td>
<td>0603</td>
</tr>
<tr>
<td>4</td>
<td>1005</td>
<td>0402</td>
</tr>
<tr>
<td>5</td>
<td>0603</td>
<td>0201</td>
</tr>
</tbody>
</table>

![Device guide](image1)

![Device guide for 0603](image2)
An excessively large gap between the DUT and device guide frame will result in contact failure between the DUT and electrode, or poor measurement accuracy or repeatability. Be sure to select a device guide frame that fits the DUT configuration.

If the DUT size does not fit any frame in the attached device guide, prepare a suitable frame using the supplied blank device guide. For details, see “Working with Device Guide”.

Figure 3-2  Electrode Spacing

Electrode plate  Electrode plate for 0603

[mm]
Be sure to superpose the device guide onto the electrode plate in the proper orientation and with the correct side facing up. Otherwise, adequate electrode spacing cannot be created. As shown in Figure 3-3 when viewed from above, on the correct face of the device guide there are two marks at positions 90 degrees apart clockwise from a single position. Superpose the device guide onto the electrode plate so that all these marks are aligned with the corresponding marks on the electrode plate. For a 0603 device, correct electrode spacing can be created regardless of whether the mark on the device guide is aligned with the corresponding mark on the electrode plate.
Changing the Orientation of or Replacing the Device Guide and Electrode Plate

Change the orientation of the device guide and electrode plate so that the selected device guide frame is located at the measuring position. For a 0603 device, replace the attached device guide and electrode plate with ones supplied in Option 001.

**Step 1.** Loosen the knobs on the sliding block, and remove the pressure unit from the electrode unit, referring to Figure 1-4 on page 9

**Step 2.** Unscrew the screws that fix the guide holder. Then remove the guide holder, device guide, and electrode plate (Figure 3-4)

![Figure 3-4 Removing the Device Guide and Electrode Plate](image)

**NOTE**

If it is difficult to take out the electrode plate, turn the electrode unit upside down to remove the plate. Do not use force to take out the electrode plate, otherwise it may be deformed.

**Step 3.** Mount the device guide and electrode plate so that the selected device guide frame is located at the measuring position. Ensure that the marks on the device guide are aligned with those on the electrode plate (Figure 3-5). For a 0603 DUT, replace the attached device guide and electrode plate with ones supplied in Option 001 (Figure 3-6).
Step 4. Install the guide holder, and tighten the screws to secure it.
Step 5. Mount the pressure unit onto the electrode unit according to Figure 1-2 on page 8

Step 6. Connect the test fixture with the measuring instrument. Connect the test fixture with the measuring instrument according to “Connecting the Test Fixture with a Measuring Instrument” on page 13 in Chapter 1.
Working with Device Guide

To measure a DUT whose size does not fit any frame in the attached device guide, it is necessary to prepare a suitable device guide frame. Prepare a frame with reference to the dimensions of the blank device guide shown in Figure 3-7 and the electrode positioning shown in Figure 3-8.

Reference Data for Preparing a Device Guide Frame

Figure 3-7 Dimensional Drawing of a Blank Device Guide

Figure 3-8 Electrode Positioning

A guide holder is placed onto the device guide. Figure 3-9-A shows the inside diameter of the guide holder. Figure 3-9-B shows the movable range of the pressure rod.
Determine the position of the frame to be prepared, keeping in mind the following requirements:

- The electrode of the DUT must maintain equal contact with both the center electrode and electrode plate.
- The electrode of the DUT must have a large contact area, and the electrode space between the center electrode and electrode plate must be as large as possible.
- The pressure rod must be able to press the center of the DUT to stabilize the DUT during measurement.

**Example of Preparing the Device Guide**

**Preparing the Device Guide for a 2520 SMD**

The figure below shown an example of preparation for a device guide for a 2520 SMD. For a 2520 SMD, the measuring position for a 2012 device is used (electrode space: 1.5mm).
Prepare the frame at the position shown in Figure 3-10. This position is within the movable range of the pressure rod (4 mm on each lateral side from the center). In a frame at this position, the electrodes on both lateral sides of the DUT can be placed in equal contact by 0.4-mm width with the center electrode and the electrode plate.

**Example of Preparing the Device Guide for an SOT 23 Device (Case Style 287)**

The figure below shows an example of preparing a device guide for an SOT 23 device. For an SOT 23 device, the measuring position for a 1608 device is used (electrode space: 1.0 mm).
Operation
Working with Device Guide

Prepare a frame at the position shown in Figure 3-11. In a frame at this position, the electrodes on both lateral sides of the DUT can be placed in equal contact by 0.6-mm width with the center electrode and the electrode plate.

Example of Preparing a Simple Device Guide

In order to prepare the device guide more easily, there is a method that involves precisely cutting only the 2 sides that position the device over the electrodes. Do not cut the corner hole which mounts the device guide.

The measurement accuracy when using this method is not guaranteed.

Preparing the Simple Device Guide for a 2520 SMD

The position which places the 2520 SMD is same as Figure 3-10. Cut the 2 sides precisely which fixes the device position as shown in Figure 3-12.

Figure 3-12 Example of Preparing the Simple Device Guide for a 2520 SMD

![Preparation of Simple Device Guide Frame for 2520 SMD (Example)]
Performing Fixture Compensation

To ensure accurate measurement, it is necessary to perform fixture compensation before measurement. For the 16197A, measure the SHORT compensation and OPEN compensation data. If the DUT size or the measuring position is changed, perform fixture compensation again.

**NOTE** If a temperature change greater than ± 5°C occurs after fixture compensation, perform the fixture compensation from the beginning.

**Measuring the SHORT Compensation Data**

With the fixture SHORT state using a supplied shorting bar, measure the SHORT compensation data.

**Step 1.** Rotate the pressure adjusting nut to adjust the pressure on the pressure rod to the same value as used for measurement.

**Step 2.** Loosen the knobs on the sliding block, and adjust the position of the pressure unit so that the end of the pressure rod is located at the center of the device guide frame where the shorting bar will be placed (Figure 3-13).

**Figure 3-13 Adjusting the Pressure Unit Position**

**Step 3.** Press the lever to the limit (Figure 3-14,1). With the lever pressed, push in the latch (Figure 3-14,2), and then release the lever (Figure 3-14,3). The pressure rod is then fixed at its raised position.
Step 4. Using tweezers, place an appropriate shorting bar on the electrode along the device guide frame.

**CAUTION** Each shorting bar is made exclusively for a particular device size. Do not use a shorting bar of the wrong size.

Handle each shorting bar with tweezers, taking care not to soil it. A soiled shorting bar may impair measurement accuracy and repeatability.

**NOTE** Take care so that the correct face of the shorting bar is placed in contact with the electrode.
Step 5. Press the lever; the latch is disengaged (Figure 3-16,1). Slowly release the lever to lower the pressure rod (Figure 3-16,2).

Note: Shorting bars can wear out. Therefore, each time before using a shorting bar, measure and compare its resistance with that of a new shorting bar. For details, see “Operation Check” on page 69.

Step 6. Measure the SHORT compensation data according to the operation manual for the measuring instrument to be used.

Note: Adjust the position of the pressure unit in advance so that a shorting bar can be pressed at its center by the end of the pressure rod.

When measurement is not being done, lower the pressure rod so it rests on an unoccupied area of the device guide.
Performing Fixture Compensation

**Figure 3-17  Standby Position of the Pressure Road**

Confirm that the end of the pressure rod is not deformed. Replace the rod if deformed. For the replacement part, see “Replaceable Parts” on page 61.

**Measuring OPEN Compensation Data**

With the fixture in an OPEN state, measure the OPEN compensation data.

**Step 7.** Press the lever to raise the pressure rod, and remove the shorting bar used to measure the SHORT compensation data (Figure 3-18,1).

**Step 8.** Press the lever to raise the pressure rod (Figure 3-18,2), and push the latch to secure the pressure rod in its raised position (Figure 3-18,3).

**Figure 3-18  Setting the Fixture for OPEN State**
Step 9. Measure OPEN compensation data according to the operation manual for the measuring instrument to be used.
Connecting and Measuring the DUT

Connect the DUT with the electrode, and carry out the measurement.

**Step 1.** Place the DUT on the electrode in an appropriate device guide frame (Figure 3-19,1).

**Step 2.** Press the lever to disengage the latch (Figure 3-19,2), and slowly release the lever to lower the pressure rod (Figure 3-19,3).

**Step 3.** Perform the measurement according to the operation manual for the measuring instrument to be used.

**CAUTION**

The DUT may become hot during measurement. If the temperature of the DUT rises, the end of the pressure rod may be deformed. If this occurs, decrease the pressure on the pressure rod to prevent deformation of the end of the rod.

**NOTE**

To ensure accurate and repeatable measurements, place the DUT alongside a fixed edge of each device guide frame. Testing a 3216 DUT, for instance, uses the 3216/3225 frame. Since this frame is dimensioned to fit with a 3225 device, some clearance remains in the frame if it is used for a 3216 DUT. Therefore, it is necessary to place the DUT alongside a fixed edge of the frame.
Operation
Connecting and Measuring the DUT

Figure 3-20  DUT Position in the Device Guide Frame
Operation
Connecting and Measuring the DUT
4 User Maintenance

This chapter describes the operations to perform before starting measurement, and the procedures necessary to ensure accurate measurements.

Description

Necessity of User Maintenance

Through repeated use, the fixture's measuring performance will gradually deteriorate over time due to smearing on the contact faces from solder buildup, and to mechanical wear and deformation of the contact faces themselves. To continually achieve optimal measurement results, it is important to keep the contact faces in good condition and take appropriate action before such wear or deformation occurs. Therefore, the fixture should be properly cared for by implementing each of the maintenance items shown in Table 4-1.

Table 4-1 Maintenance Items

<table>
<thead>
<tr>
<th>Name</th>
<th>Frequency of implementation</th>
<th>Contents</th>
<th>Target parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning</td>
<td>Several times a day</td>
<td>Cleaning the fixture</td>
<td>Entire fixture</td>
</tr>
<tr>
<td>Electrode deterioration check</td>
<td>Before using the fixture for the first time after delivery/ After replacement of parts</td>
<td>Acquisition of reference values&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Center electrode, Electrode plate</td>
</tr>
<tr>
<td></td>
<td>Once a day/Before fixture compensation</td>
<td>Determining the deviation from reference values&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Center electrode, Electrode plate</td>
</tr>
</tbody>
</table>
Maintenance of the fixture is important especially to ensure fine or highly accurate measurement, since deteriorated measurement performance of the fixture has a significant effect on the measurement results. Depending on the required measurement performance, it may be necessary to increase the frequency of maintenance and/or adopt more strict criteria for each maintenance item.

The electrodes and shorting bars are consumable. Of all the fixture components, these parts are most likely to affect the measurement results. The electrodes tend to deteriorate gradually since they can easily be smeared with solder transferred from the DUT during measurements. Because shorting bars are used to determine the zero reference for fixture compensation, smeared or deformed shorting bars can directly influence measurement results. This chapter describes the general user maintenance requirements, focusing primarily on the electrodes and shorting bars.

### Table 4-1 Maintenance Items

<table>
<thead>
<tr>
<th>Name</th>
<th>Frequency of implementation</th>
<th>Contents</th>
<th>Target parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement of parts</td>
<td>When deterioration check result is unacceptable</td>
<td>Changing the orientation of the contact assembly, or replacement of parts</td>
<td>Center electrode, Electrode plate, Shorting bar</td>
</tr>
<tr>
<td>Assembly check</td>
<td>After replacement of parts</td>
<td>Evaluation of absolute $L_s$ and $R_s$ values</td>
<td>Center electrode, Electrode plate, Shorting bar</td>
</tr>
</tbody>
</table>

a. For details, see “Acquiring Reference Values” on page 48.
Cleaning

Smeared electrodes result in poor measurement accuracy and repeatability. Periodically clean the electrodes to ensure accurate measurements.

Areas Requiring Cleaning

The following areas require cleaning.

- The area of the center electrode that will be in contact with the electrode of the DUT
- The area of the electrode plate that will be in contact with the electrode of the DUT

Cleaning Method

Use a cleaning rod (Keysight part number: 5182-7586) to clean the electrodes. Remove smears on the above-mentioned contact area by wiping with the white rubber portion of the cleaning rod. Take care not to damage the electrode parts.
Figure 4-2 Cleaning Rod

CAUTION
Do not file off the smears; filing part surfaces may cause poor measurement accuracy or repeatability.

NOTE
If smears cannot be removed, replace the part. For the replacement method, see “Changing the Orientation of or Replacing the Contact Assembly” on page 67.
Deterioration Check

A deterioration check must be performed to determine the state of deterioration of the fixture and to confirm whether the fixture is providing the required measurement accuracy. The deterioration check comprises three operations: “Setting user limit values,” “Acquiring Reference Values”“Electrode Deterioration Check”. In the deterioration check, the impedance values (Rs, Ls) of the fixture itself are measured at a discretionary frequency. It is recommended to use the frequency at which the fixture is normally used.

Perform “Setting user limit values” in the following cases:
- When using the fixture for the first time after delivery
- When changing the required measurement accuracy

Perform “Acquiring Reference Values” in the following cases:
- When using the fixture for the first time after delivery
- After replacing parts

Perform “Electrode Deterioration Check” in the following cases:
- Once a day, and before conducting fixture compensation

Example Settings of User Limit Values

User limit values for the deterioration check should be set appropriately according to the type of DUT, required measurement accuracy, and so on. Example settings of user limit values are shown below.

To evaluate an inductor (L:10nH, Q:10) at a frequency (f) of 100 MHz with a measurement accuracy of around 20%:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>10nH</td>
</tr>
<tr>
<td>Q</td>
<td>10</td>
</tr>
<tr>
<td>Frequency</td>
<td>100MHz</td>
</tr>
<tr>
<td>Required measurement accuracy</td>
<td>20% for both L and Q</td>
</tr>
</tbody>
</table>

The reactance X and resistance R of the inductor under the above-mentioned conditions can be obtained as follows:

\[
R = \frac{X}{Q} = 0.6\Omega
\]

\[
X = 2\pi fL = 6\Omega
\]
Therefore, \( Q = \frac{X}{R} = \frac{(2\pi fL)}{R} \). Accordingly, if \( R \) fluctuates by 20% (120 m\( \Omega \)), \( Q \) will change by about 20%; and if \( L \) fluctuates by 20% (2 nH), both \( L \) and \( Q \) will change by about 20%. In other words, to measure \( L \) and \( Q \) at an accuracy of 20% or less error, errors in \( L \) and \( R \) must be 2 nH and 120 m\( \Omega \) at the most, respectively. Considering that both \( L \) and \( R \) may fluctuate, and allowing for possible causes of error other than a deteriorated fixture, the errors must be set smaller than the above-mentioned values. For the present example, with the error set at 25% for both \( L \) and \( R \), the user limit values for \( L \) and \( R \) are set at 500 p\( \Omega \) and 30 m\( \Omega \), respectively.

**Note**

Note that the above settings are just an example. Actually, user limit values should be varied depending on the measuring conditions and type of DUT.

**Note**

In actual measurement, some of the effect of electrode deterioration is canceled by SHORT compensation. However, it is recommended to set user limit values on the assumption that deviations from the reference values affect the entire measurement results, as shown in the above example.

Record the user limit values in the “Check Sheet” on page 51. For the method of recording, see “Example Entry in Check Sheet” on page 51.

**Acquiring Reference Values**

To obtain reference values, measure the impedance (\( R_s, L_s \)) of the fixture before deterioration. It is recommended to take measurements at a frequency at which the fixture is normally used. It is necessary to obtain reference values using electrodes and shorting bars for all sizes of DUTs that will be subject to actual measurement.

“Acquiring reference values” is necessary in the following cases:

– When using the fixture for the first time after delivery
– After replacement of parts

– Shorting bars (supplied as accessories)
– Impedance measuring instrument (calibrated at the 7mm connector end)

**Necessary equipment**

Set the fixture compensation for the measuring instrument to OFF.

**CAUTION**

Check that each shorting bar is not deformed or stained.
User Maintenance
Deterioration Check

Procedure for Acquiring Reference Values for the Electrode Deterioration Check

Step 1. Clean each electrode and shorting bar using the method described in “Cleaning” on page 45.

Step 2. At the actual DUT measurement position, connect an appropriate shorting bar with the electrode to set the fixture for the SHORT state (See Figure 3-16 on page 37).

Step 3. Measure Rs and Ls according to the Operation and Service Manual for the measuring instrument.

Step 4. Record the Rs and Ls readings as reference values in the “Check Sheet” on page 51

Step 5. From the reference values and the user limit values determined in the preceding section, calculate the upper and lower limit values, and record them in the Check Sheet.

Electrode Deterioration Check

Measure the impedance of the fixture in the SHORT state to check for electrode deterioration. Use a shorting bar suited to the size of the actual DUT.

The electrode deterioration check is necessary in the following cases:

— Once a day, and before conducting fixture compensation

— Shorting bars (supplied as accessories)

— Impedance measuring instrument (calibrated at the 7-mm connector end)

Necessary equipment

CAUTION

Set the fixture compensation of the measuring instrument to OFF. Set all other functions to the same states according to “Acquiring Reference Values”

Electrode Deterioration Check Procedure

Step 1. Clean each electrode and shoring bar using the method described in “Cleaning” on page 45.

Step 2. Perform the measurement, with the measuring instrument set for the same conditions as mentioned in “Procedure for Acquiring Reference Values for the Electrode Deterioration Check” on page 49.

Step 3. Record the Rs and Ls readings, as well as their acceptability, in the “Check Sheet” on page 51.
**Step 4.** If the results are unacceptable, replace the center electrode or the electrode plate.

**CAUTION**

By changing the orientation of the contact assembly, it is possible to take measurements using an unused clean area of the center electrode. For details, see “Changing the Orientation of or Replacing the Contact Assembly” on page 67

**CAUTION**

An electrode deterioration check using a deformed or stained shorting bar may produce unacceptable check results. Replace the shorting bar if it is deformed or if it cannot be cleaned.
User Maintenance
Check Sheet

Check Sheet

Example Entry in Check Sheet

The following tables show an example entry of electrode deterioration check results in the Check Sheet.

Example Entry of Electrode Deterioration Check Results

<table>
<thead>
<tr>
<th>DUT Size</th>
<th>2012</th>
</tr>
</thead>
</table>

Table 4-2  
Example Entry of Reference Values and User Limit Values

<table>
<thead>
<tr>
<th>Frequency(a)</th>
<th>Measurement parameter</th>
<th>Reference value [(a)](b)</th>
<th>User limit value [(b)](c)</th>
<th>Lower limit [(a-b)]</th>
<th>Upper limit [(a+b)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MHz</td>
<td>Rs</td>
<td>40 m(\Omega)</td>
<td>30 m(\Omega)</td>
<td>10 m(\Omega)</td>
<td>70 m(\Omega)</td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.34 nH</td>
<td>0.5 nH</td>
<td>1.84 nH</td>
<td>2.84 nH</td>
</tr>
<tr>
<td>800 MHz</td>
<td>Rs</td>
<td>220 m(\Omega)</td>
<td>40 m(\Omega)</td>
<td>180 m(\Omega)</td>
<td>260 m(\Omega)</td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.32 nH</td>
<td>0.4 nH</td>
<td>1.92 nH</td>
<td>2.72 nH</td>
</tr>
</tbody>
</table>

a. User's discretionary value  
b. Enter the values obtained in section “Acquiring Reference Values” on page 48  
c. For entry, see “Example Settings of User Limit Values” on page 47

Table 4-3  
Example Entry of Checking History

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Frequency</th>
<th>Measurement parameter</th>
<th>Measurement value</th>
<th>Acceptability</th>
<th>Set position of pressure adjusting nut</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/10/11 9:30</td>
<td>100 MHz</td>
<td>Rs</td>
<td>50 mW</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.5 nH</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2000/10/11 9:35</td>
<td>800 MHz</td>
<td>Rs</td>
<td>250 mW</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.6 nH</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2000/10/12 9:30</td>
<td>100 MHz</td>
<td>Rs</td>
<td>55 mW</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.6 nH</td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>2000/10/12 9:35</td>
<td>800 MHz</td>
<td>Rs</td>
<td>285 mW</td>
<td>(\times^a)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ls</td>
<td>2.7 nH</td>
<td></td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

a. Replace parts if check results are not acceptable.
Electrode Deterioration Check

DUT size ______________________

Table 4-4 Reference Values and User Limit Values

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Measurement parameter</th>
<th>Reference value [a]</th>
<th>User limit value [b]</th>
<th>Lower limit [a-b]</th>
<th>Upper limit [a+b]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td>mΩ</td>
<td>mΩ</td>
<td>mΩ</td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td>pH</td>
<td>pH</td>
<td>pH</td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td>mΩ</td>
<td>mΩ</td>
<td>mΩ</td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td>pH</td>
<td>pH</td>
<td>pH</td>
<td></td>
</tr>
</tbody>
</table>

Table 4-5 Checking History

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Frequency</th>
<th>Measurement parameter</th>
<th>Measurement value</th>
<th>Acceptability</th>
<th>Set position of pressure adjusting nut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rs</td>
<td>mΩ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ls</td>
<td>pH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Assembly Check

Each time after replacing a part, conduct an assembly check to confirm that the fixture has been assembled properly. The procedure for performing an assembly check is identical with that for an operation check. For the procedure, see “Operation Check” on page 69.
User Maintenance
Assembly Check
5 Specifications and Supplemental Performance Characteristics

This chapter provides specifications and supplemental performance characteristics of the 16197A test fixture.

Definitions

Specification (spec): Warranted performance. Specifications include guardbands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Supplemental Information is intended to provide information useful in applying the instrument, but that is not covered by the product warranty. The information is denoted as typical, or nominal.

Typical (typ.): Expected performance of an average unit which does not include guardbands.

Nominal (nom.): A general, descriptive term that does not imply a level of performance.
### Specifications

<table>
<thead>
<tr>
<th>Applicable Instruments</th>
<th>Refer to the Table 1-2 and Table 1-3 on page 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicable DUT Type</td>
<td>Surface Mount Device with bottom electrodes.</td>
</tr>
<tr>
<td>Applicable DUT Size</td>
<td>Model</td>
</tr>
<tr>
<td></td>
<td>3225</td>
</tr>
<tr>
<td></td>
<td>3216</td>
</tr>
<tr>
<td></td>
<td>2012</td>
</tr>
<tr>
<td></td>
<td>1608</td>
</tr>
<tr>
<td></td>
<td>1005</td>
</tr>
<tr>
<td></td>
<td>0603</td>
</tr>
</tbody>
</table>

- **Frequency**: DC to 3 GHz
- **Maximum Voltage**: ± 42V peak max. (AC+DC)
- **Maximum Current**: 5A
- **Operating Environment**
  - **temp.**: -55°C to +85°C
  - **humidity**: 15% to 95%RH (@ wet bulb temp. < 40°C)
- **Non Operating Environment**
  - **temp.**: -55°C to +85°C
  - **humidity**: ≤90% RH (@ wet bulb temp. <65°C)
- **Dimension**: Approximately 160 (W) × 86 (D) × 70 (H) mm (nom.)
- **Weight**: Approximately 300 g (nom.)
- **Safety Standards**:
  - EN61010-1:2001
  - IEC61010-1:2001
  - CAN/CSA C22.2 No.61010-1-12
  - INSTALLATION CATEGORY I
  - POLLUTION DEGREE 2
  - INDOOR USE
Supplemental Performance Characteristics

This section provides useful data on the 16197A. These supplemental performance characteristics should not be considered specifications.

Additional Error

Additional errors are calculated as follows.

|Z| Measurement

Additional error for Impedance Ze [%] is calculated by substituting the values in the table below into the following equation.

\[ Ze \% = \pm \left( A + \frac{Zs}{Zx} + Yo \times Zx \right) \times 100 \]

where

\( A \% \)  Test Fixture's Proportional Error [%]
\( Yo \ [S] \)  Test Fixture's Open Repeatability [S]
\( Zs \ [\Omega] \)  Test Fixture's Short Repeatability [\Omega]
\( Zx \ [\Omega] \)  Measured Impedance Value of DUT [\Omega]

\[
\begin{array}{|c|c|}
\hline
Zs & (30 + 150 \times f) \times 10^{-3}[W] \\
Yo & (2 + 30 \times f) \times 10^{-6}[S] \\
A & 1.2 \times f^2 [%] \\
\hline
\end{array}
\]

where \( f \) is frequency (GHz)

D Measurement

Additional error for Dissipation Factor De is calculated by using the additional error for Impedance Ze [%] as follows.

If \( Dx \leq 0.1 \):

\[ De = \frac{Ze}{100} \]

If \( 0.1 < Dx \leq 0.5 \):

\[ De = \left( \frac{Ze}{100} \right) \times \left( 1 + Dx \right) \]

where \( Dx \) is the measured value of D. It is necessary for Ze to be below 10%.

\[ \text{D is not expressed as a percentage but as an absolute value.} \]
Rs (ESR) Measurement

Additional error $R_{se} [%]$ of the Rs measurement is calculated by using the additional error for Impedance $Z_{e} [%]$ as follows.

If $D_x \leq 0.1$:

$$R_{se} [%] = \frac{Z_{e}}{D_x}$$

If $0.1 < D_x \leq 0.5$:

$$R_{se} [%] = \left(\frac{Z_{e}}{D_x}\right) \times \sqrt{1 + \left(\frac{D_x}{0.5}\right)^2}$$

$D_x$ is the measured value of $D$ and is calculated as follows.

$$D_x = 2 \times \pi \times f \times C_{sx} \times R_{sx},$$

where

$f$: measurement signal frequency

$C_{sx}$: measured value of $C_s$

$R_{sx}$: measured value of $R_s$
Residual Inductance of the Shorting Bar

The usual method to compensate the test fixture's residual inductance is to let SHORT = 0H. In this method, the measurement result is the relative value of the measured impedance to the shorting bar's impedance. The short bar's residual inductance as a result of its size and shape is not estimated.

On the other hand, there is a definition method to let SHORT = x H. In this method, the measurement result is the absolute value of the device's impedance. The short bar's residual inductance as a result of its size and shape is estimated under specific conditions and is used as a reference value. This method is useful for devices with values which are close to the short conditions of the measurement system.

The reference inductance values presented Table 5-1 were simulated as the relative difference to a disk-type 0 W termination on either the 7mm or the 3.5mm connector. The measurement of these short bars under other conditions than shown below cannot reproduce the reference inductance values.

Table 5-1  Residual Inductance (Typical)

<table>
<thead>
<tr>
<th>Shorting Bar Set</th>
<th>1 [mm]</th>
<th>d [mm]</th>
<th>h [mm]</th>
<th>Offset [mm]</th>
<th>Connector</th>
<th>Inductance (Typical)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 x 0.3 x 0.3</td>
<td>0.6</td>
<td>0.3</td>
<td>0.3</td>
<td>0.0585</td>
<td>1 mm</td>
<td>0.1nH</td>
</tr>
<tr>
<td>1.0 x 0.5 x 0.5</td>
<td>1.0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.75</td>
<td>3.5 mm</td>
<td>0.5 nH</td>
</tr>
<tr>
<td>1.6 x 0.8 x 0.8</td>
<td>1.6</td>
<td>0.8</td>
<td>0.8</td>
<td>0.45</td>
<td>3.5 mm</td>
<td>0.4 nH</td>
</tr>
<tr>
<td>2.0 x 1.2 x 0.8</td>
<td>2.0</td>
<td>1.2</td>
<td>0.8</td>
<td>1.5</td>
<td>7 mm</td>
<td>0.9 nH</td>
</tr>
<tr>
<td>3.2 x 1.6 x 0.8</td>
<td>3.2</td>
<td>1.6</td>
<td>0.8</td>
<td>0.9</td>
<td>7 mm</td>
<td>0.8 nH</td>
</tr>
</tbody>
</table>

Figure 5-2  Simulation Setup
Specifications and Supplemental Performance Characteristics
Residual Inductance of the Shorting Bar
6 Service

This chapter describes the replaceable parts of the fixture, and the method for replacing parts.

Replaceable Parts

The support parts for RoHS and non-RoHS compliance 16197A Bottom Electrode SMD Test Fixture with the exploded views and tables shown below. Due to limited availability of RoHS compliance station and technical difficulties in RoHS soldering, only parts and support level that do not require RoHS soldering are supported. Replace all defective parts with RoHS compliance part number. Do not disassemble each unit into smaller components than shown in these exploded views. If a defective part to be replaced is part of a component that cannot be disassembled, place an order for the entire component. Defective parts or components may be sent to Keysight Technologies local sales/service office for repair.

Perform "Operation Check" in 16197A Operation and Service Manual each time a part is replaced.
Pressure Unit

Figure 6-1 Exploded View of Pressure Unit Assembly

Table 6-1 Replaceable Parts (Pressure Unit)

<table>
<thead>
<tr>
<th>Ref /D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>RoHS Compliant Replacement Part</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3050-1138</td>
<td>Washer</td>
<td>1</td>
<td>3050-1138 Washers</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>16197-25002</td>
<td>Pressure rod</td>
<td>1</td>
<td>16197-25002 Pressure rod</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1480-1093</td>
<td>R-pin</td>
<td>1</td>
<td>1480-1240 R-pin</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>16197-05001</td>
<td>Lever</td>
<td>1</td>
<td>16197-05001 Lever</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>N/A</td>
<td>Pressure unit</td>
<td>1</td>
<td>N/A Pressure unit</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
## Replaceable Parts (Pressure Unit)

<table>
<thead>
<tr>
<th>Ref /D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>RoHS Compliant Replacement Part</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>1460-2662</td>
<td>Spring</td>
<td>1</td>
<td>1460-2662</td>
<td>Spring</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>16197-23003</td>
<td>Shaft</td>
<td>1</td>
<td>16197-23003</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>16197-23004</td>
<td>Shaft</td>
<td>1</td>
<td>16197-23004</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>1460-2663</td>
<td>Spring</td>
<td>1</td>
<td>1460-2663</td>
<td>Spring</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>16197-24004</td>
<td>Pressure adjusting nut</td>
<td>1</td>
<td>16197-24004</td>
<td>Pressure adjusting nut</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>16197-24005</td>
<td>Screw</td>
<td>1</td>
<td>16197-24005</td>
<td>Screw</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>0515-1185</td>
<td>Screw</td>
<td>1</td>
<td>0515-1185</td>
<td>Screw</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>16197-24003</td>
<td>Knob</td>
<td>2</td>
<td>16197-24003</td>
<td>Knob</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>N/A</td>
<td>Sliding block</td>
<td>1</td>
<td>N/A</td>
<td>Sliding block</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>0515-1550</td>
<td>Screw M3</td>
<td>2</td>
<td>0515-0372</td>
<td>Screw M3</td>
<td>2</td>
</tr>
</tbody>
</table>
Electrode Unit

Figure 6-2 Exploded View of Electrode Unit Assembly

Table 6-2 Replaceable Parts (Electrode Unit)

<table>
<thead>
<tr>
<th>Ref /D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>RoHS Compliant Replacement Part</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0515-1077</td>
<td>Screw M-2.0</td>
<td>2</td>
<td>0515-1077</td>
<td>Screw M-2.0</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>16197-25004</td>
<td>Guide holder</td>
<td>1</td>
<td>16197-25004</td>
<td>Guide holder</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16197-25005</td>
<td>Device guide</td>
<td>1</td>
<td>16197-25005</td>
<td>Device guide</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>16197-00603</td>
<td>Electrode plate</td>
<td>1</td>
<td>16197-00603</td>
<td>Electrode plate</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table 6-2

**Replaceable Parts (Electrode Unit)**

<table>
<thead>
<tr>
<th>Ref /D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>RoHS Compliant Replacement Part</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>16197-25007</td>
<td>Device guide (for Option 001)</td>
<td>1</td>
<td>16197-25007</td>
<td>Device guide (for Option 001)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>16197-00604</td>
<td>Electrode plate (for Option 001)</td>
<td>1</td>
<td>16197-00604</td>
<td>Electrode plate (for Option 001)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>16197-25006</td>
<td>Device guide (blank)</td>
<td>1</td>
<td>16197-25006</td>
<td>Device guide (blank)</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>16197-00601</td>
<td>Plate</td>
<td>1</td>
<td>16197-00601</td>
<td>Plate</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>0515-0914</td>
<td>Screw M3 x 0.5</td>
<td>4</td>
<td>0515-1946</td>
<td>Screw M3 x 0.5</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>0515-0952</td>
<td>Screw M2 x 0.4</td>
<td>4</td>
<td>0515-2151</td>
<td>Screw M2 x 0.4</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>N/A</td>
<td>Plate</td>
<td>1</td>
<td>N/A</td>
<td>Plate</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>16197-60001</td>
<td>Contact assembly (including contact center)</td>
<td>1</td>
<td>16197-60001</td>
<td>Contact assembly (including contact center)</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>16197-24001</td>
<td>Flange</td>
<td>1</td>
<td>16197-24001</td>
<td>Flange</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>1250-0907</td>
<td>Contact center</td>
<td>1</td>
<td>1250-0907</td>
<td>Contact center</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Other Parts

### Table 6-3

**Replaceable Parts (Other Parts)**

<table>
<thead>
<tr>
<th>Ref /D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>RoHS Compliant Replacement Part</th>
<th>Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16191-29005</td>
<td>Shorting bar 1.0 x 0.5</td>
<td>1</td>
<td>16191-29005</td>
<td>Shorting bar 1.0 x 0.5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>16191-29006</td>
<td>Shorting bar 1.6 x 0.8</td>
<td>1</td>
<td>16191-29006</td>
<td>Shorting bar 1.6 x 0.8</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table 6-3: Replaceable Parts (Other Parts)

<table>
<thead>
<tr>
<th>Ref / D</th>
<th>Part Number</th>
<th>Description</th>
<th>Qty</th>
<th>Replacement Part Description</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>16191-29007</td>
<td>Shorting bar 2.0 x 1.2</td>
<td>1</td>
<td>16191-29007 Shorting bar 2.0 x 1.2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>16191-29008</td>
<td>Shorting bar 3.2 x 1.6</td>
<td>1</td>
<td>16191-29008 Shorting bar 3.2 x 1.6</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>16197-29001</td>
<td>Shorting bar (for Option Kit 001)</td>
<td>1</td>
<td>16197-29001 Shorting bar (for Option Kit 001)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>8710-2081</td>
<td>Tweezers</td>
<td>1</td>
<td>8710-2081 Tweezers</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>8710-0909</td>
<td>Allen wrench</td>
<td>1</td>
<td>8710-0909 Allen wrench</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>16193-60002</td>
<td>Magnifying glass</td>
<td>1</td>
<td>16193-60002 Magnifying glass</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>16197-60050</td>
<td>Carrying case</td>
<td>1</td>
<td>16197-60060 Carrying case</td>
<td>1</td>
</tr>
</tbody>
</table>
Changing the Orientation of or Replacing the Contact Assembly

If the center electrode of the contact assembly is smeared, an unused clean area of the center electrode can be used simply by changing the orientation of the contact assembly. This section describes the method for changing the orientation of or replacing the contact assembly.

To change the contact assembly orientation or replace the contact assembly, it is necessary to use a 1.5-mm Allen wrench (Keysight part number: 8710-0909) and a Phillips screwdriver.

Procedure for Changing the Orientation of or Replacing the Contact Assembly

1. Take off the guide holder, and remove the device guide and electrode plate. (See to Figure 3-4 on page 28).

2. Remove the four screws from the upper side of the fixture, and then remove the contact assembly and flange.

Figure 6-3 Removing the Contact Assembly
Service
Changing the Orientation of or Replacing the Contact Assembly

3. Rotate the contact assembly and set it in place so that a clean area of the center electrode is at the measuring position.

4. Install the flange, and tighten the screws.

5. Install the device guide and electrode plate. Then mount the guide holder and secure it with the screws.
Operation Check

This section describes the operation check method. Be sure to perform the operation check after each time a part is replaced.

Open Impedance Check

Conduct an Open impedance check with the fixture set for the OPEN state.

Necessary equipment

- Shorting bars (supplied as accessories)
- Impedance measuring instrument (calibrated at the 7-mm connector end)

**NOTE**

If a measuring instrument other than the 4291B is to be used, make the equivalent settings according to the Operation and Service Manual for the instrument to be used.

**Step 1.** Prepare a measuring instrument calibrated at the 7-mm connector end. Connect the test fixture with this instrument.

**Step 2.** Set the fixture for the OPEN state, at the DUT measuring position (see Figure 3-18 on page 38).

**Step 3.** Make the settings for the 4291B as follows.

<table>
<thead>
<tr>
<th>Table 6-4</th>
<th>Settings for the Measuring Instrument (Keysight 4291B)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measuring Condition</strong></td>
<td><strong>Setting</strong></td>
</tr>
<tr>
<td>Measurement parameter</td>
<td>Cp</td>
</tr>
<tr>
<td>Start frequency</td>
<td>100MHz</td>
</tr>
<tr>
<td>Stop frequency</td>
<td>1GHz</td>
</tr>
<tr>
<td>OSC Level</td>
<td>0.5V</td>
</tr>
<tr>
<td>Number of points</td>
<td>2</td>
</tr>
<tr>
<td>Point averaging factor</td>
<td>16</td>
</tr>
<tr>
<td>Points averaging</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Step 4.** Under these conditions, measure Cp at 100 MHz and 1 GHz separately.

**Step 5.** Confirm that the Cp value is within the typical range shown in Table 6-5.

<table>
<thead>
<tr>
<th>Table 6-5</th>
<th>OPEN Impedance Check: Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parameter</strong></td>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td>Cp</td>
<td>100MHz</td>
</tr>
<tr>
<td>Cp</td>
<td>1GHz</td>
</tr>
</tbody>
</table>
Short Impedance Check

Upon completion of the open impedance check, carry out a short impedance check with the fixture set for the SHORT state.

**Step 1.** At the DUT measuring position, connect an appropriate shorting bar with the electrode to secure the fixture for the SHORT state. (See Figure 3-16 on page 37).

**Step 2.** Make the settings for the 4291B as follow.

**Table 6-6 Settings for the Measuring Instrument (Keysight 4291B)**

<table>
<thead>
<tr>
<th>Measuring Condition</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement parameter</td>
<td>Ls</td>
</tr>
<tr>
<td>Start frequency</td>
<td>100MHz</td>
</tr>
<tr>
<td>Stop frequency</td>
<td>1GHz</td>
</tr>
<tr>
<td>OSC Level</td>
<td>0.5V</td>
</tr>
<tr>
<td>Number of points</td>
<td>2</td>
</tr>
<tr>
<td>Point averaging factor</td>
<td>16</td>
</tr>
<tr>
<td>Points averaging</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Step 3.** Under this condition, measure Ls at 100MHz and 1GHz, separately.

**Step 4.** Confirm that the Ls value is within the typical range shown in Table 6-7

**Table 6-7 SHORT Impedance Check: Typical**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>Typical (Absolute value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ls</td>
<td>100MHz</td>
<td>2.3nH ± 1nH^a</td>
</tr>
<tr>
<td>Ls</td>
<td>1GHz</td>
<td>2.3nH ± 1nH^a</td>
</tr>
</tbody>
</table>

^a. The values given above are common to shorting bars of all sizes.

Short-impedance Measurement Repeatability Check

Repeat short impedance measurement to check for the repeatability of measurement.

**Step 1.** Upon completion of the short impedance check, disconnect the shorting bar and connect it again with the electrode.

**Step 2.** Under the same measuring conditions as given above, measure Ls again at 100MHz and 1GHz, separately.

**Step 3.** Confirm that the Ls value is within the typical range shown in Table 6-7.
Step 4. Obtain the difference between the first and second Ls measurements.

Step 5. Confirm that the variation in measurements is within the typical range shown in Table 6-8.

**Table 6-8**  
SHORT Impedance Check: Typical

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Frequency</th>
<th>Typical (Difference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ls</td>
<td>100MHz</td>
<td>± 45pH</td>
</tr>
<tr>
<td>Ls</td>
<td>1GHz</td>
<td>± 45pH</td>
</tr>
</tbody>
</table>
Service
Operation Check